

PATENT APPLN. NO. 10/792,281
RESPONSE UNDER 37 C.F.R. §1.116

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REMARKS

Claim Rejections - 35 USC § 103

The Office has maintained the rejections under 35 U.S.C. § 103(a) of claims 1, 5 and 7 over U.S. Pre-grant Publication No. 2004/0101763 ("Kotato") in view of U.S. Patent No. 6,022,518 ("Yamazaki") and of claim 4 over Kotato in view of Yamazaki as applied to claim 1, and further in view of JP 2001-297794 (identified in the Final Action as "Kotado") that were made in the first Action.

Applicants respectfully submit that the rejections are not proper because the disclosure of the primary reference relied on in each of the rejections, Kotato, would have led the art-skilled person away from the modification of Kotato proposed by the Office.

In the response filed June 7, 2007, to the first Action, applicants argued that the electrolyte of Kotato cannot be properly modified to include an amount of γ -butyrolactone of not less than 95% by volume and not less than 97% by volume, in the nonaqueous electrolyte as recited in claim 1 (as amended in the response) and as recited in claim 4, respectively, because Kotato requires that the nonaqueous electrolyte include ethylene carbonate in an amount of 10% by volume or more (see paragraph [0017]). Applicants noted that paragraph [0006] of Kotato, cited by the Office as disclosing

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an amount of γ -butyrolactone of between 50 and 95% by volume, relates to prior art with respect to Kotato and not to the invention of Kotato.

The Office has taken the position in the Final Action that paragraph [0006] shows that a person of ordinary skill in the art would be aware that γ -butyrolactone has been used in a nonaqueous electrolyte in an amount of between 50 and 95% and would be motivated to use γ -butyrolactone in an amount within this range in the invention of Kotato.

Applicants respectfully submit that the position of the Office is not logical. The invention of Kotato was made to overcome the disadvantages of the prior art electrolyte in which between 50 and 95% of γ -butyrolactone is used with ethylene carbonate and vinylene carbonate. A person of ordinary skill in the art would not have been motivated to use an amount of γ -butyrolactone (in the electrolyte of Kotato in combination with ethylene carbonate and at least one vinylene carbonate) that Kotato describes as not providing satisfactory properties with a reasonable expectation of good results.

Notwithstanding that the 35 U.S.C. § 103(a) rejections are not believed to be proper, applicants have amended the claims to limit the nonaqueous solvent to γ -butyrolactone.

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The lithium secondary battery recited in the amended claims is unobvious and patentably distinguishes over Kotato for the following reasons.

Kotato discloses an electrolyte comprising not less than 50 % by volume of γ -butyrolactone, 0.01 - 5 % by weight of VC and 0.01 - 5 % by weight of VEC (total amount of VC and VEC 0.02 - 6 % by weight) as additives to prevent generation of gas during storage at a high temperature. JP Laid-open 2000/235868 cited as prior art in Kotato discloses an electrolyte including 50 - 95 % by volume of γ -butyrolactone and EC and VC.

The present invention and the prior art utilize the high boiling point and excellent heat stability of γ -butyrolactone (refer to paragraph [0005] of the present application). However, γ -butyrolactone decomposes on a negative electrode and the characteristics thereof are deteriorated (refer to paragraph [0006] of the present application).

Kotato, to avoid problems relating to gas generation in the battery when stored at high temperatures, provides an electrolyte which includes 50 - 90 % by volume of butyrolactone, not less than 10 % by volume of EC, and contains VC and VEC as additives. However, when an amount of an additive such as EC in the nonaqueous electrolyte is excessive, heat stability of the nonaqueous

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electrolyte is reduced and stability of the lithium battery cannot be improved (refer to paragraph [0008] of the present application). The present invention has been made to solve this problem.

In the present invention in which a lithium secondary battery includes an electrolyte in which a solute is dissolved in a nonaqueous solvent consisting of γ -butyrolactone and a negative electrode including a carbon material as an active material where the carbon material has a ratio (I_D/I_G) of a Raman spectrum intensity (R) obtained by Raman spectroscopy of 0.2 or greater, VC and VEC as additives are used to prevent of decomposition of the γ -butyrolactone and to obtain excellent charge-discharge characteristics. That is, a first carbon material having high crystallinity as a core material of a negative electrode is at least partially coated by a second carbon material having lower crystallinity than the first carbon material to prepare a carbon material having an R value of not less than 0.2. Furthermore, VC and VEC are used as additives to form a fine film having excellent permeability of lithium ion on the surface of the amorphous carbon material, and to prevent decomposition of γ -butyrolactone at the interface between the negative electrode and the nonaqueous electrolyte (see paragraph [0016]).

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Regarding a carbon material used for the negative electrode, Yamazaki discloses a carbon material having not greater than 0.45 of R to improve characteristics at a low temperature and cycle characteristics. There is a description that the surface is graphitic and the inside is carbonaceous. The carbon material is different from that of the present invention. The purpose of the invention of Yamazaki is different from the present invention which is directed to the prevention of decomposition of γ -butyrolactone. For these reasons also, the art-skilled person would not have been motivated to modify the nonaqueous electrolyte of Kotato by eliminating the EC and the proposed modification of Kotato would not have resulted in the lithium secondary battery of the present invention.

Removal of the 35 U.S.C. § 103(a) rejections and a notice of allowability are now believed to be in order.

The foregoing is believed to be a complete and proper response to the Office Action dated July 20, 2007, and is believed to place this application in condition for allowance. If, however, minor issues remain that can be resolved by means of a telephone interview, the Examiner is respectfully requested to contact the undersigned attorney at the telephone number indicated below.

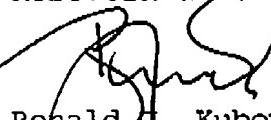
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In the event that this paper is not considered to be timely filed, applicants hereby petition for an appropriate extension of time. The fee for any such extension can be charged to Deposit Account No. 111833.

In the event any additional fees are required, please also charge Deposit Account No. 111833.

Respectfully submitted,
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